



UNITED STATES  
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

May 16, 2000

LICENSEE: BALTIMORE GAS AND ELECTRIC COMPANY  
FACILITY: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2  
SUBJECT: SUMMARY OF APRIL 13, 2000, MEETING REGARDING THE  
CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 -  
PROBABILISTIC RISK ANALYSIS (TAC NOS. MA8335 AND MA8336)

On April 13, 2000, the U.S. Nuclear Regulatory Commission (NRC) staff held a meeting at the NRC offices in Rockville, Maryland, with representatives from Baltimore Gas and Electric Company (BGE), the licensee for Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 to discuss the licensee's Probabilistic Risk Analysis (PRA). The list of meeting attendees is included as Enclosure 1. Enclosure 2 is a copy of the slides presented by the licensee at the meeting.

The licensee indicated that the current calculated Core Damage Frequency (CDF) for Calvert Cliffs Unit 1 is  $2.1 \times 10^{-4}$  consisting of internal events ( $1.3 \times 10^{-4}$ ) and external events ( $8.0 \times 10^{-5}$ ). They stated that they plan to target a Calvert Cliffs CDF of  $1 \times 10^{-4}$  and plan to accomplish this through a combination of plant modifications, procedure changes and PRA model improvements.

The licensee presented a list of PRA changes that reduced the CDF and also a list of changes that increased the CDF. They also discussed the importance of certain systems having an effect on risk reduction.

BGE indicated that the next PRA update is scheduled to be issued by the 3rd quarter 2000, and they expect to see some additional CDF reduction changes due to: improved plant trip performance, updated failure and unavailability data, refined switchgear room heat-up rate calculation, new service water heat exchangers, and improved flood analysis. They estimated that these changes would reduce the CDF to approximately  $1.7 \times 10^{-4}$ . They also believe the update will reduce the internal events to  $< 1 \times 10^{-4}/\text{yr}$ .

The licensee also plans to make additional plant and procedure changes. They estimate that these changes would result in a reduction of 20 percent CDF. BGE also discussed potential plant changes and procedure changes.

May 16, 2000

- 2 -

The licensee invited the staff to visit the site to get a better understanding of the details of the Calvert Cliffs PRA.

/RA/

Alexander W. Dromerick, Sr. Project Manager, Section 1  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-317

Enclosures: As stated

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Alexander W. Dromerick, Sr. Project Manager, Section 1  
Project Directorate I  
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Unit Nos. 1 and 2

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MEETING ATTENDEES

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

APRIL 13, 2000

<u>NAME</u>	<u>ORGANIZATION</u>
Alexander Dromerick	NRR/PDI-1
Jim Trapp	Region I
Bill Cook	Region I
Brian Richter	NRR/DRIP/RGEB
Nick Saltos	NRR/DSSA/SPSB
Mark Reinhart	NRR/DSSA/SPSB
Tom Pritchett	BGE/CCNPP
David Holm	BGE
Leslie Collins	ABB-CENP
Gareth Parry	NRR/DSSA
E. G. Adensam	NRR/DLPM/LPDI
Marie Pohida	NRR/DSSA/SPSB
Roy Woods	RES/DRAA/PRAB
Mark Rubin	NRR/DSSA/SPSB
Noriyuki Shiukai	CHUBU Electric Co. Japan
Masato Watanabe	CHUBU Electric Power Co. Japan
Kunio Ito	Japan NUS Co.
Gary Pavis	BGE/Technical Services Engineering
Bruce Montgomery	BGE/Nuclear Regulatory Matters
Bruce Mrowca	BGE/Reliability Engineering
Rich Barrett	NRC/NRR/DSSA/SPSB
Bob Palla	NRC/NRR/DSSA/SPSB
Fred Bower	NRC/RI/BR1/Calvert RI

# Calvert Cliffs PRA

April 13, 2000

April 12, 2000

## Agenda

- |                             |  |
|-----------------------------|--|
| ■ Management Overview       | Tom Pritchett<br>Manager<br>Nuclear Engineering Department         |
| ■ Calvert Cliffs PRA        | Bruce Mrowca<br>Principal Engineer<br>Reliability Engineering Unit |
| ■ Plant & Procedure Changes | Dave Holm<br>Superintendent<br>Nuclear Operations Section          |
| ■ Closing Remarks           | Tom Pritchett  |

2

## Vision

*Consistent with our site vision to generate electricity safely, efficiently, and reliably, we plan to improve CCNPP CDF.*

3

## Objective

- We plan to target a CCNPP CDF of  $1 \times 10^{-4}$
- We plan to accomplish this through a combination of:
  - Plant modifications
  - Procedure changes
  - PRA model improvements

4

## What have we done?

- Benchmarking
- PRA Model Improvements
- Plant improvements

5

## Calvert Cliffs PRA

Bruce Mrowca

## Calvert Cliffs Unit 1 PRA

### ■ Scope

- At-power
- Level 2 (limited Level 3 developed for SAMA)
- Internal and External (fire, seismic and wind)

### ■ Construction

- Large event-tree (RISKMAN)
  - Over 200 plant functions modeled
- Limited use of screening
  - Over 150 fires modeled
  - Over 40 flood initiating events modeled
- Significant use of plant specific data

7

## Calvert Cliffs Unit 1 Calculated CDF

	■ Submitted (IPE+IPEEE)	$3.3 \times 10^{-4}$
	- IPE Submittal December 1993	
	■ Internal Events	$2.4 \times 10^{-4}$
	- IPEEE Submittal August 1997	
	■ Seismic	$1.3 \times 10^{-5}$
	■ Fire	$7.3 \times 10^{-5}$
	■ High Winds	$4.4 \times 10^{-6}$
	Total	$9.0 \times 10^{-5}$
	■ Current Value (April 1999)	$2.1 \times 10^{-4}$
	- Internal Events	$1.3 \times 10^{-4}$
	- External Events	$8.0 \times 10^{-5}$

46% Reduction

8

## PRA Changes

### ■ CDF Reductions

- SR EDG and SBO DG addition
- ATWS Model improved
- Revised RCP LOCA success criteria
- Low pressure feed using condensate added
- Revised feed and bleed success criteria
- Consider Unit availability in CDF calculation
- Reduced LOCA frequencies

9

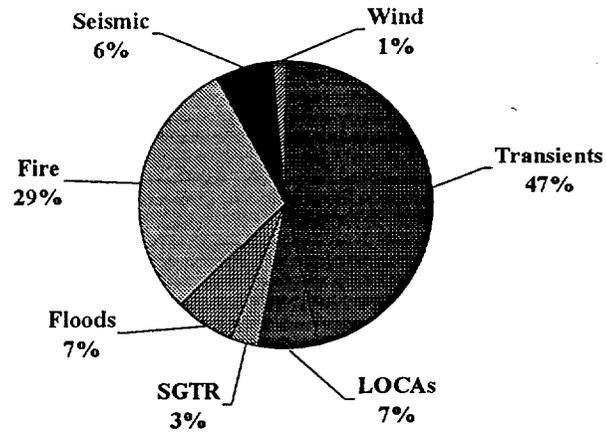
## PRA Changes

### ■ CDF Increases

- Inverter, battery, transformer and other common cause groups added
- Multiple bus initiating events added
- Improved human action methodology
- Indication dependencies on human actions added

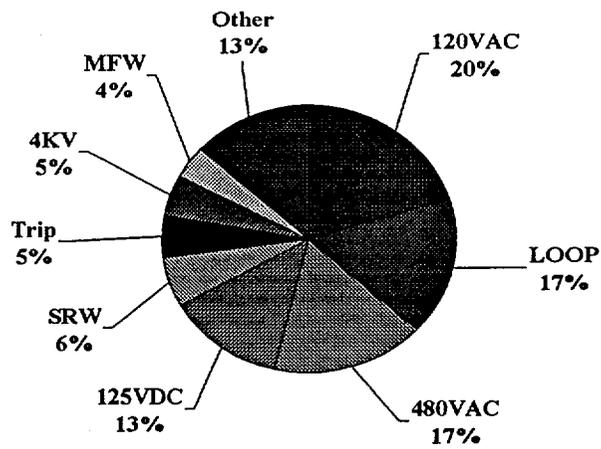
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Unit 1 CDF =  $2.1 \times 10^{-4}$ /year



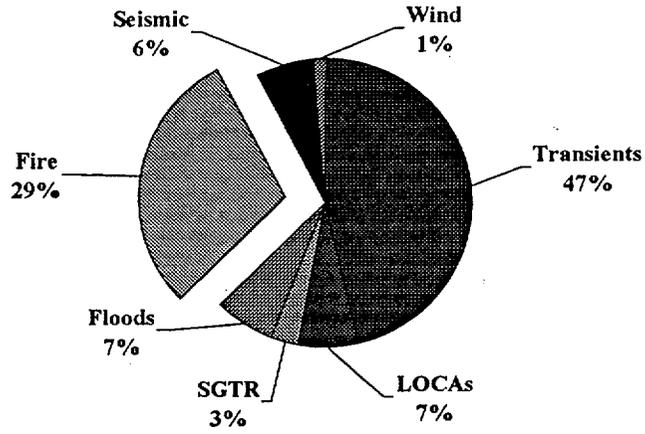
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Transient CDF =  $1 \times 10^{-4}$ /year



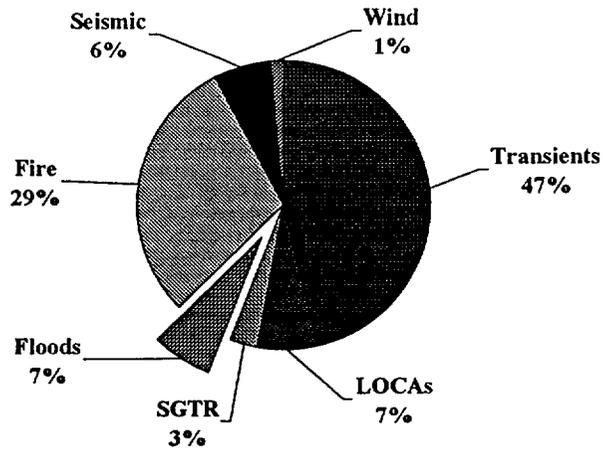
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Fire =  $6 \times 10^{-5}$ /year



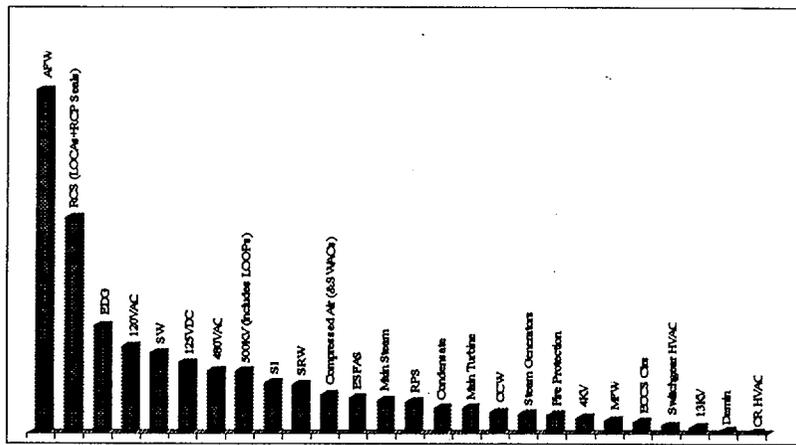
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Flood =  $1.4 \times 10^{-5}$ /year



14

## Important Systems - Risk Reduction



Unit 1 PRA

15

## Next PRA Update

- Scheduled to be issued by 3rd quarter 2000
- Expect to see some additional CDF reduction - changes include:
  - improved plant trip performance
  - updated failure and unavailability data
  - refined switchgear room heat-up rate calculation
  - new SRW heat exchangers
  - improved flood analysis
- 20% estimated CDF reduction  $\Rightarrow 1.7 \times 10^{-4}$
- Believe update will yield Internal Events  $< 1 \times 10^{-4}$

16

# Plant and Procedure Changes

Dave Holm

## Planned Plant Changes

Change	ECD	CDF Reduction
1. Addition of condenser pit sprinklers	2001/2002	3%
2. Addition of watertight door (SAMA)	2003	3%
3. 0C diesel power to NSR 4KV Buses	2001	2%
4. Analysis of ECCS pump cooler dependency	2000	2 to 4%
5. Resolution of the Spurious Safety System Actuation (SAMA)	TBD*	10%

Estimate an additional 20% CDF reduction  $\Rightarrow 1.3 \times 10^{-4}$   
Note: An analysis of the integrated impact of all the changes has not been performed.

\* Scope not complete.

## Potential Plant Changes

Change	CDF Reduction
1. Addition of battery back-up to S/G level indication	2%
2. Removing DC power dependency from AFW steam supply valves	2%
3. Changing failure mode of CCW containment isolation valves	0.2%

Estimate an additional 4% CDF reduction  $\Rightarrow 1.2 \times 10^{-4}$   
Note: An analysis of the integrated impact of all the changes has not been performed

19

## Potential Procedure Changes

Change	CDF Reduction
1. Cross connect 4KV buses	2%
2. Feed both Units from a single motor-driven AFW pump	1 to 2%
3. Improved operator performance	1 to 2%

Estimate an additional 5% CDF reduction  $\Rightarrow 1.1 \times 10^{-4}$   
Note: An analysis of the integrated impact of all the changes has not been performed

20